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EXAMINER	
TIMORY, KABIR A	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/779,825	Applicant(s) UNGERBOECK, GOTTFRIED	
	Examiner Kabir A. Timory	Art Unit 2609	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 17 February 2004.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-24 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-24 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 17 February 2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 3/26/2007.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cherubini et al (US Patent Number 6,741,551) in view of De Gaudenzi et al (US Patent Number 7,123,663).

Regarding claim1:

As shown in figure 9 & 10, Cherubini et al. discloses a zero excess bandwidth modulation method, the method comprising:

- TH (Tomlinson-Harashima) precoding (figure 7, column 9, lines 58-64) of the sequence of discrete-valued modulation (figure 5, column 6, lines 66-67, & column 7, lines 1-3) symbols according to a predetermined overall channel symbol response having spectral zeroes at edges (column 8, lines 50-53, & column 10, lines 12-14) of a corresponding Nyquist band (column 6, lines 16-19), thereby generating a plurality of discrete-time transmit signals at a modulation rate (Discrete Fourier Transform DTF generates discrete signals in time domain) (figure 5);

- inserting the plurality of discrete-time transmit signals into means to generate a continuous-time transmit signal by appropriate discrete-time filtering, digital-to-analog conversion (DAC) (figure 10, column 8, lines 62-66), and continuous-time filtering (figure 4);
- ensuring, within the means to generate the continuous-time transmit signal (this limitation is part of digital to analog conversion) (figure 10, DAC, column 8, lines 63-66) that the continuous-time transmit signal has spectral zeroes at the edges of the corresponding Nyquist band, which equals a bandwidth of the available transmission band, and that any spectral components outside of the available transmission band are substantially suppressed (column 8, lines 16-19, & column 10, lines 12-27); and
- launching the filtered, continuous-time transmit signal into the communication channel (figure 10).

Cherubini et al. discloses all of the subject matter as described above except for specifically teaching encoding a plurality of information bits, thereby generating a sequence of discrete-valued modulation symbols.

However, De Gaudenzi et al., in the same field of endeavor, teaches encoding a plurality of information bits, thereby generating a sequence of discrete-valued modulation symbols (figure 11, Trellis Encoder).

One of ordinary skill in the art would have clearly recognized that in order to change a signal such as bistream into code format encoder devices are used. Encoding the data along with Trellis Coded Modulation (TCM) allows highly efficient transmission of information over communication channels. To convert the signal into

bistream and output the complex symbols it would have been obvious to one ordinary skill in the art at the time the invention was made to use an encoder as taught by De Gaudenzi et al. in the encoding and modulation of data in a communication system. Using an encoder in a modulating system is advantageous because they provide good result during the code generation in the system. Also, it will allow the data to transmitted over the communication channels more efficiently.

Regarding claims 2 and 14:

Cherubini et al. further discloses:

the predetermined overall channel response is characterized as

$$h(D) = 1 + h_1 D + h_2 D^2 + \cdots;$$
$$D = e^{-j2\pi fT} (= z^{-1});$$

f is frequency;

T is an inverse of the bandwidth of the available transmission band;

h1, h2, ... are constant valued coefficients; and

h(D) is zero when D = -1.

(please see column 6, lines 1-5 and equation (1)):

$$y_k = \sum_{n=-\infty}^{\infty} \sum_{m=0}^{M-1} A_n^{(m)} h_{k-nM}(m).$$

Regarding claims 3 and 15:

Cherubini et al. discloses all of the subject matter as described above except for specifically teaching:

encoding of the plurality of information bits into a plurality of encoded bits; and mapping the plurality of encoded bits into a plurality of modulation symbols according to a symbol constellation and a corresponding mapping function, thereby generating the sequence of discrete-valued modulation symbols.

However, De Gaudenzi et al., in the same field of endeavor, teaches encoding of the plurality of information bits into a plurality of encoded bits (figure 11, Trellis Encoder); and mapping the plurality of encoded bits into a plurality of modulation symbols according to a symbol constellation and a corresponding mapping function (figure 11, Mapper), thereby generating the sequence of discrete-valued modulation symbols (column 14, lines 2-7).

One of ordinary skill in the art would have clearly recognized that in order to change a signal such as bistream into code format encoders. When modulating signal using modulation techniques such as Trellis Code Modulation (TCM), trellis encoders and constellation mapper are used. To convert the signal into bistream and output the complex symbols it would have been obvious to one ordinary skill in the art at the time the invention was made to use an encoder and a symbol mapper as taught by De Gaudenzi et al. in the encoding and modulation of data in a communication system. Using an encoder along with a constellation mapper in a modulation technique is advantageous because they provide good result during the code generation in the system. Also, it will allow the data to transmitted over the communication channels more efficiently.

Regarding claims 4 and 16:

Cherubini et al. discloses all of the subject matter as described above except for specifically teaching:

encoding a subset of information bits of the plurality of information bits into a plurality of encoded bits; and mapping the plurality of encoded bits and at least one uncoded information bits into a plurality of modulation symbols according to a symbol constellation and a corresponding mapping function, thereby generating the sequence of discrete-valued modulation symbols.

However, De Gaudenzi et al., in the same field of endeavor, teaches encoding a subset of information bits of the plurality of information bits into a plurality of encoded bits (figure 11, Trellis Encoder); and
mapping the plurality of encoded bits and at least one uncoded information bits into a plurality of modulation symbols according to a symbol constellation and a corresponding mapping function, thereby generating the sequence of discrete-valued modulation symbols (column 14, lines 2-7).

One of ordinary skill in the art would have clearly recognized that in order to change a signal such as bistream into code format encoders. When modulating signal using modulation techniques such as Trellis Code Modulation (TCM), trellis encoders and constellation mapper are used. To convert the signal into bistream and output the complex symbols it would have been obvious to one ordinary skill in the art at the time the invention was made to use an encoder and a symbol mapper as taught by De Gaudenzi et al. in the encoding and modulation of data in a communication system. Using an encoder along with a constellation mapper in a modulation technique is

advantageous because they provide good result during the code generation in the system. Also, it will allow the data to transmitted over the communication channels more efficiently.

Regarding claims 5 and 17:

Cherubini et al. further discloses:

TH precoding (figure 7) operates on the discrete-valued modulation symbols to perform an inverse filtering operation in accordance with the predetermined overall channel symbol response and executes modulo operations to limit signals within a predetermined signal region (figure 5, IDFT, column 6, lines 51-55), thereby generating the plurality of discrete-time transmit signals at the modulation rate (figure 5).

Regarding claims 6 and 18:

Cherubini et al. further discloses:

the sequence of discrete-valued modulation symbols has a modulation type of at least one of PAM (pulse amplitude modulation), QPSK (quadrature phase shift keying), 16 QAM (quadrature amplitude modulation), and a higher-order QAM (claim 5, 1-3).

Regarding claims 7 and 19:

Cherubini et al. further discloses:

the encoding of the plurality of information bits thereby generating the sequence of discrete-valued modulation symbols involves at least one of uncoded modulation, TCM (trellis coded modulation), TTCM (turbo trellis coded modulation), LDPC (low density parity check) encoding and modulation, and concatenated encoding and modulation (column 9, lines 28-31).

Regarding claims 8 and 20:

Cherubini et al. further discloses:

the method is performed cooperatively within a communication transmitter and a communication receiver that are communicatively coupled via the communication channel (figure 9 &10).

Regarding claims 9 and 21:

Cherubini et al. further discloses:

- receiving a continuous-time receive signal from the communication channel (figure 10);
- converting the continuous-time receive signal into a discrete-time signal by means to perform appropriate continuous-time filtering, ADC (analog-to-digital conversion) (figure 10, ADC), and discrete-time filtering (figure 10, LPF), thereby obtaining a plurality of discrete-time receive signals at the modulation rate (figure 10, DTF, T);
- ensuring, within the means to perform appropriate continuous-time filtering, ADC (figure 10, ADC), and discrete-time filtering (figure 10, LPF, that any signal and noise components (figure 10, NOISE) outside of the available transmission band is suppressed and that the discrete-time receive signal is shaped into a form corresponding to the predetermined overall channel symbol response that is assumed for the TH precoding (figure 7, TH Precoder), and
- decoding the plurality of discrete-time receive signals to generate best estimates of the sequence of discrete-valued modulation symbols and the information bits encoded therein (figure 7, T).

Regarding claims 10 and 22:

Cherubini et al. further discloses:

performing adaptive equalization when ensuring that the discrete-time receive signal is shaped into a form corresponding to the predetermined overall channel symbol response (column 7, lines 41-43, claim 17, lines 1-3) that is assumed for the TH precoding (figure 7, TH Precoder).

Regarding claims 11 and 23:

Cherubini et al. further discloses:

predetermined overall channel symbol response employed for TH referred to as h(D), is a finite impulse response (FIR)

$$h(D) = 1 + h_1 D + h_2 D + \cdots h_L D^L$$

for some finite positive integer L, or an infinite impulse response (IIR) h(D) = p(D)/q(D);

$$p(D) = 1 + p_1 D + \cdots h_P D^P \text{ and } q(D) = 1 + q_1 D + \cdots q_Q D^Q$$

(please see column 6, lines 1-5 and lines 38-45, and equation (1)):

$$y_k = \sum_{n=-\infty}^{\infty} \sum_{m=0}^{M-1} A_n^{(m)} h_{k-nM}(m).$$

Regarding claims 12 and 24:

Cherubini et al. further discloses:

The method of claim 11, wherein:

h(D) = (1 + D)/(1 - pD) for 0 <<p <1.

(please see column 6, lines 1-5 and lines 38-45, equation (2)):

$$\sum_{l} h_i(l) h^*_{l-nM}(j) = \delta_{i-j}\delta_n, \quad 0 \le i, j \le M - 1,$$

Regarding claim 13:

As shown in figure 9 & 10, Cherubini et al. discloses a zero excess bandwidth modulation communication transmitter, the transmitter comprising:

- an encoder and symbol mapper that encodes a plurality of information bits, thereby generating a sequence of discrete-valued modulation symbols (figure 10, column 5, lines 59-67, & column 6, lines 1-5);
- a TH (Tomlinson-Harashima) precoder (figure 7, column 9, lines 58-64) that performs precoding of the sequence of discrete-valued modulation (figure 5, column 6, lines 66-67, & column 7, lines 1-3) symbols according to a predetermined overall channel symbol response having spectral zeroes at edges (column 8, lines 50-53, & column 10, lines 12-14) of a corresponding Nyquist band (column 6, lines 16-19, thereby generating a plurality of discrete-time transmit signals at a modulation rate (Discrete Fourier Transform DTF generates discrete signals in time domain) (figure 5;
- means to generate a continuous-time transmit signal by appropriate discrete-time filtering, digital-to-analog conversion (DAC) (figure 10, column 8, lines 62-66), and continuous-time filtering (figure 4;
- wherein the plurality of discrete-time transmit signals is inserted into the means (figure 10, column 8, lines 62-66);

- wherein the means ensures that the continuous-time transmit signal (this limitation is part of digital to analog conversion) (figure 10, DAC, column 8, lines 63-66) has spectral zeroes at the edges of the corresponding Nyquist band, which equals a bandwidth of the available transmission band, and that any spectral components outside of the available transmission band are substantially suppressed (column 8, lines 16-19, & column 10, lines 12-27); and
- wherein the filtered, continuous-time transmit signal is launched into the communication channel from the transmit filter (figure 10).

Conclusion

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hall et al. (US Patent Number 6,999,446) discloses Adaptive, multi-rate waveform and frame structure for a synchronous, DS-CDMA system, Erving et al. (US Patent Number 7,058,147) discloses Efficient reduced complexity windowed optimal time domain equalizer for discrete multitone-based DSL modems, Noda et al. (US Pub. Number 2004/0243914) discloses Trellis code sensor and decoding apparatus.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kabir A. Timory whose telephone number is (571) 270-1674. The examiner can normally be reached on Mon - Thu 6:30AM - 4:00PM & Fri 6:30AM - 3:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shuwang Liu can be reached on (571) 272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Kabir A. Timory
April 30, 2007

Shuwang Liu

SHUWANG LIU
SUPERVISORY PATENT EXAMINER